



Georgia-Pacific

Big Island, VA

Project XL

Full-Scale Steam Reformer

Black Liquor Gasification

November 4, 1999

Technical Overview

What is Gasification?

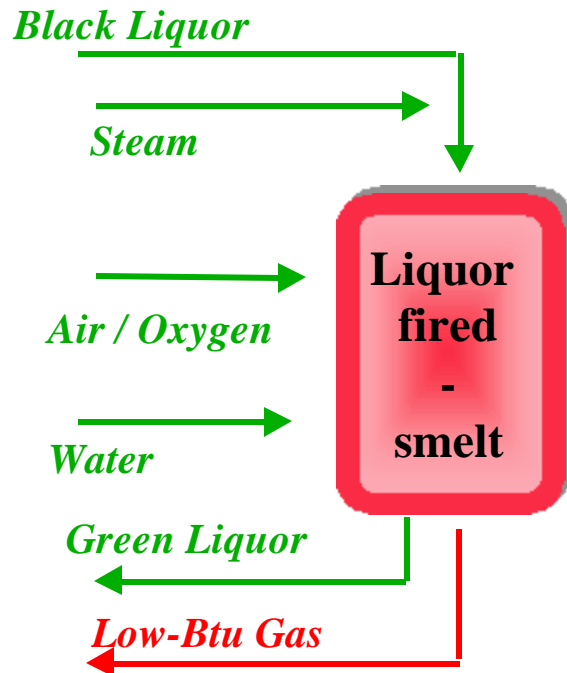
- Conversion of organics to a combustible gas

Heat + Organics = Combustible Gas

Direct vs. Indirect Gasification

DIRECT

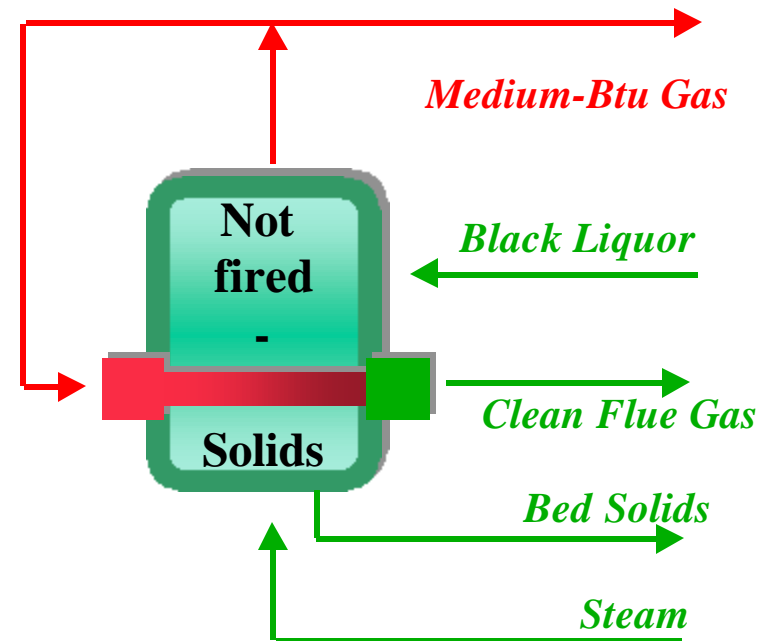
Kvaerner ChemRec



- Low-Btu Gas (75-100 Btu/dscf)
- Feed Solids Sensitive
- Smelt Formation
- Operates at 400psig/1800 deg F

INDIRECT

StoneChem Steam Reformer



- H₂-Rich Gas (250-350 Btu/dscf)
- Feed Solids Insensitive
- Smelt-Free Operation
- Operates at 5psig/1150 deg F

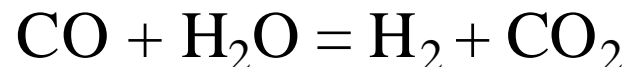
What is...

Spent Liquor Steam Reforming?

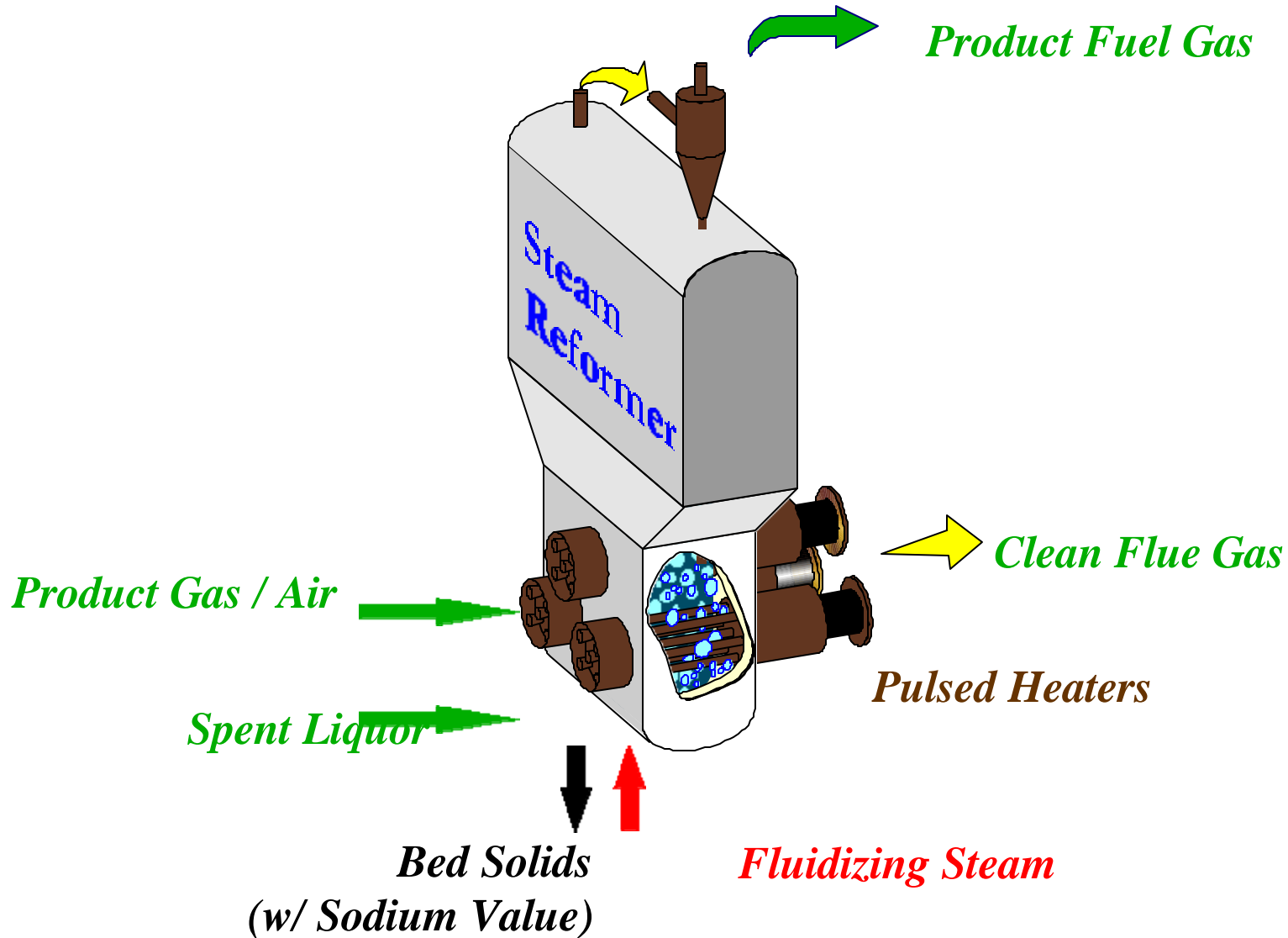
- Medium temperature, atmospheric pressure exposure to steam in the absence of air or oxygen
- Organics are converted to hydrogen and carbon monoxide



- Carbon Monoxide reacts with steam to form more hydrogen and carbon dioxide

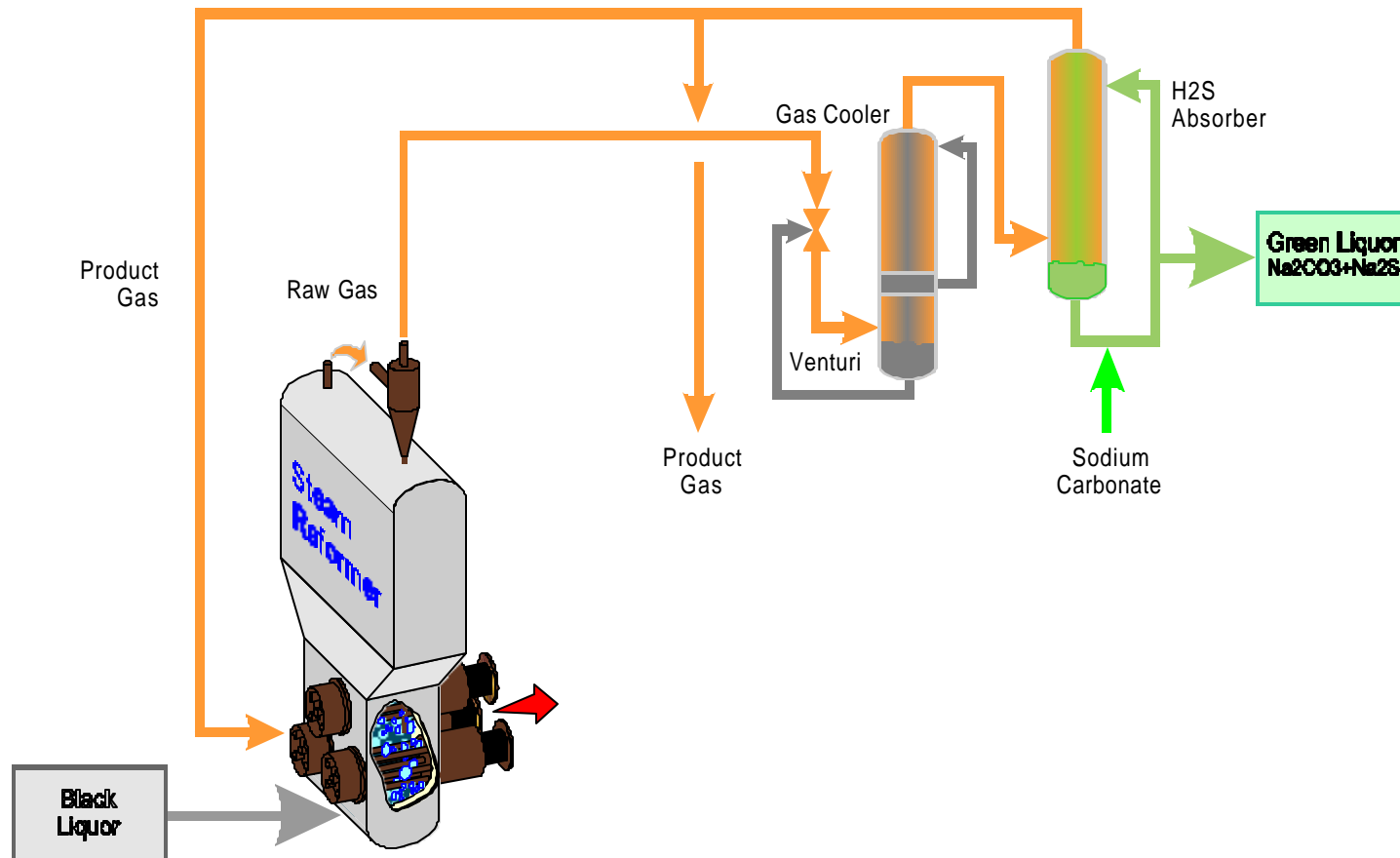


StoneChem Steam Reformer

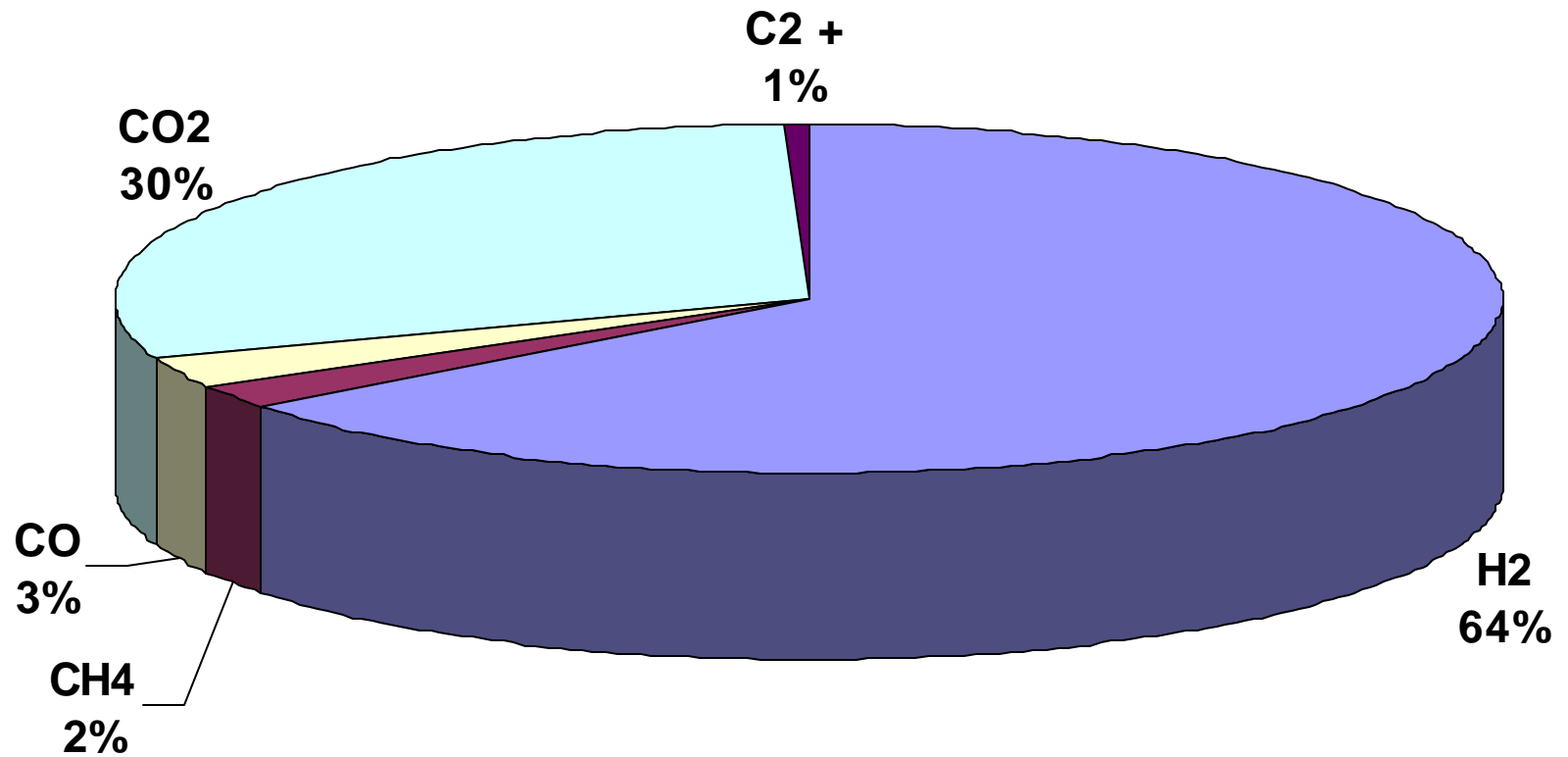


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Product Gas Flow Diagram - 1

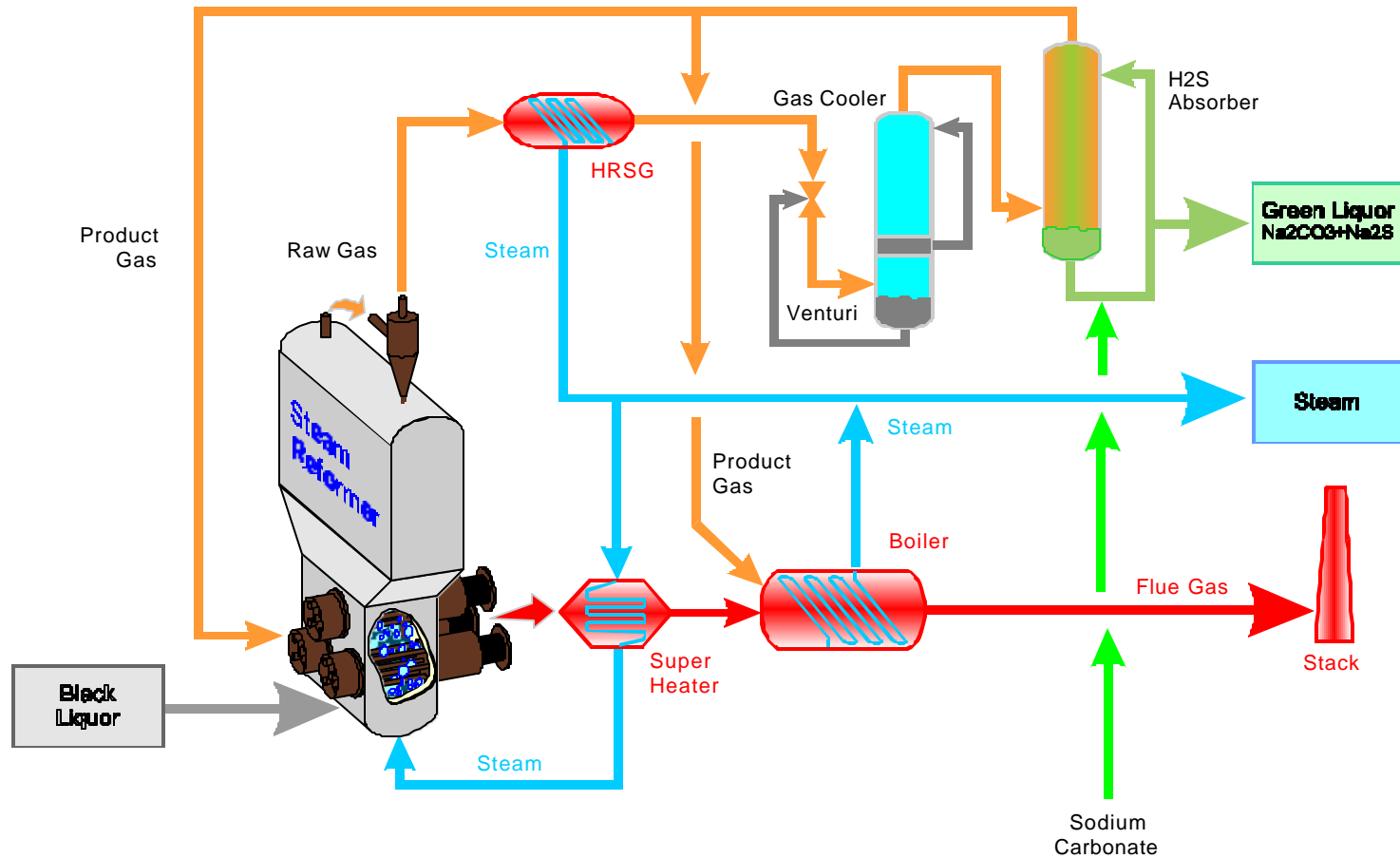


Product Gas Composition

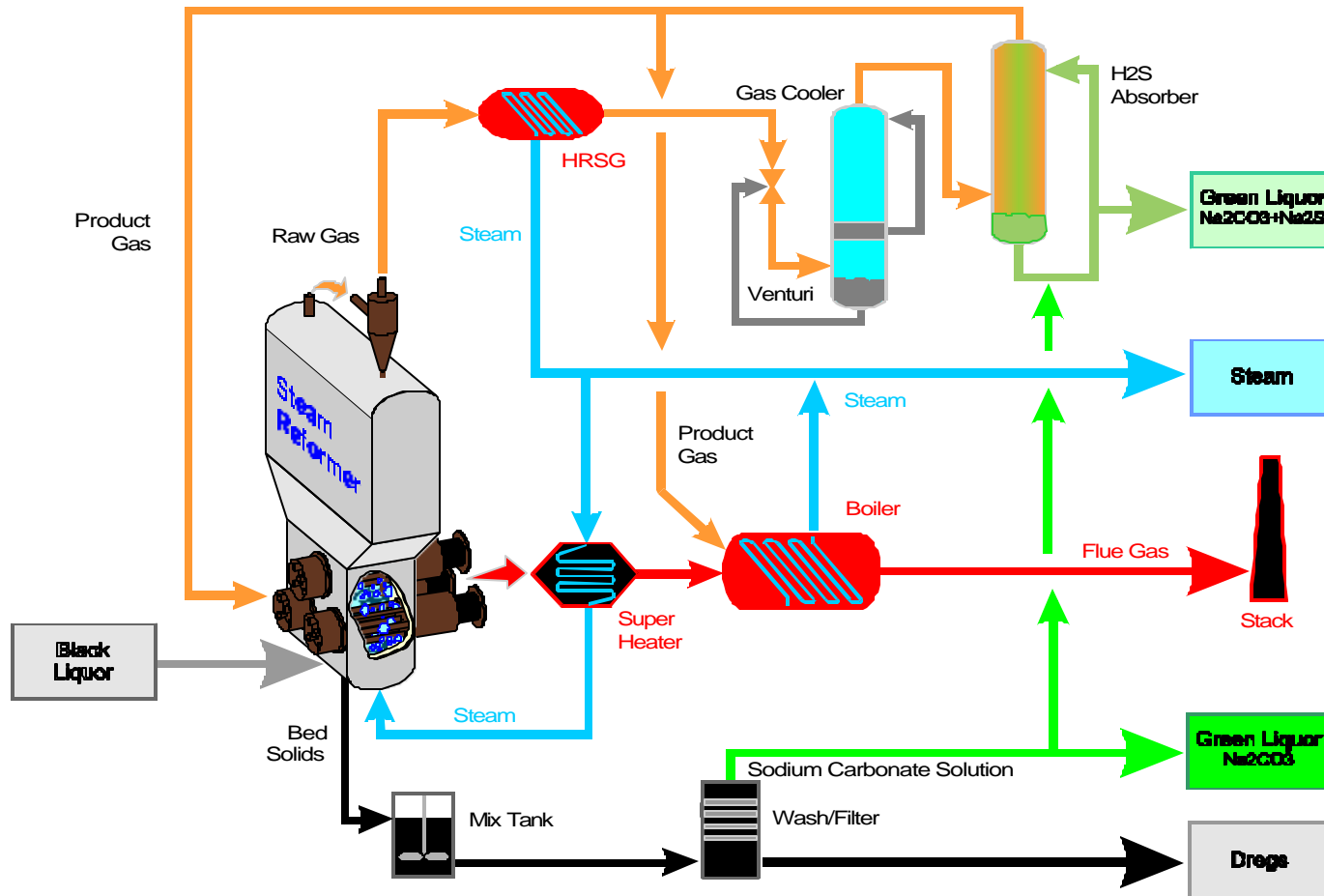


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Steam Flow Diagram - 2



Big Island Process Flow Diagram



Gasification Benefits

- Elimination of smelt-water explosion hazard
- Increased efficiency in energy conversion and chemical recovery over smelters
- Steam-Reformer process is self-sustaining
- Does not require auxiliary fossil fuel
- Possibly reduced operation/maintenance costs
- Lower emissions

Gasification Benefits

Emissions

	Smelters*		Recovery	Boiler**	Gasifier**	
	(tons/yr)	lbs/ton BLS***	(tons/yr)	lbs/ton BLS	(tons/yr)	lbs/ton BLS
NOx	142	4.99	90	2	25	1
SO2	11.8	0.41	11	0.30	1	0.04
CO	6,284	220.72	146	4.00	15	0.41
VOC	1,363	47.87	7.5	0.21	0.4	0.01
Particulate	363	12.75	15	0.41	8	0.22
* Average annual emissions 1997-1998						
** Based on current average maximum production capacity of the Pulp mill						
*** BLS - Black Liquor Solids						

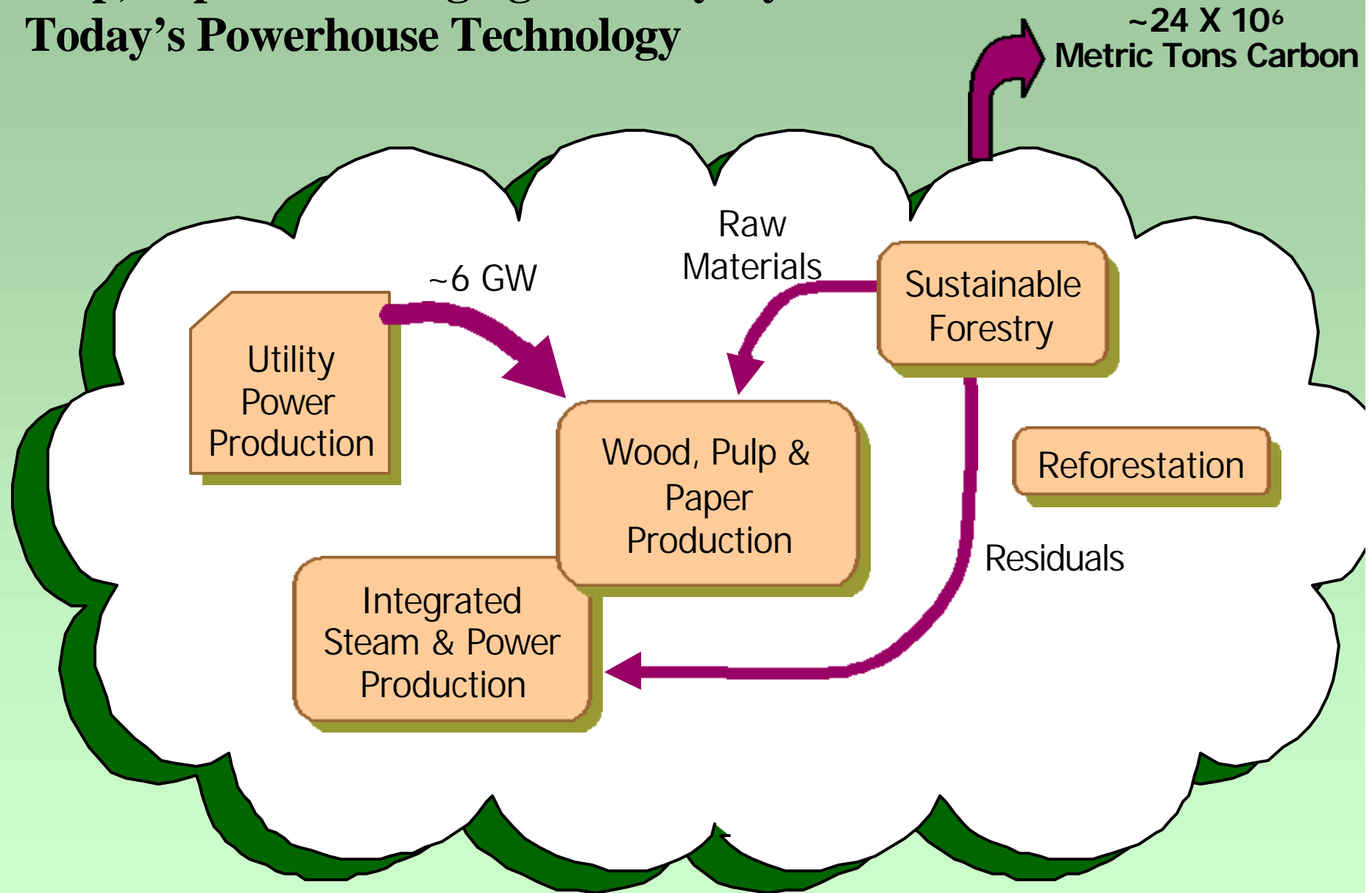
Gasification Benefits

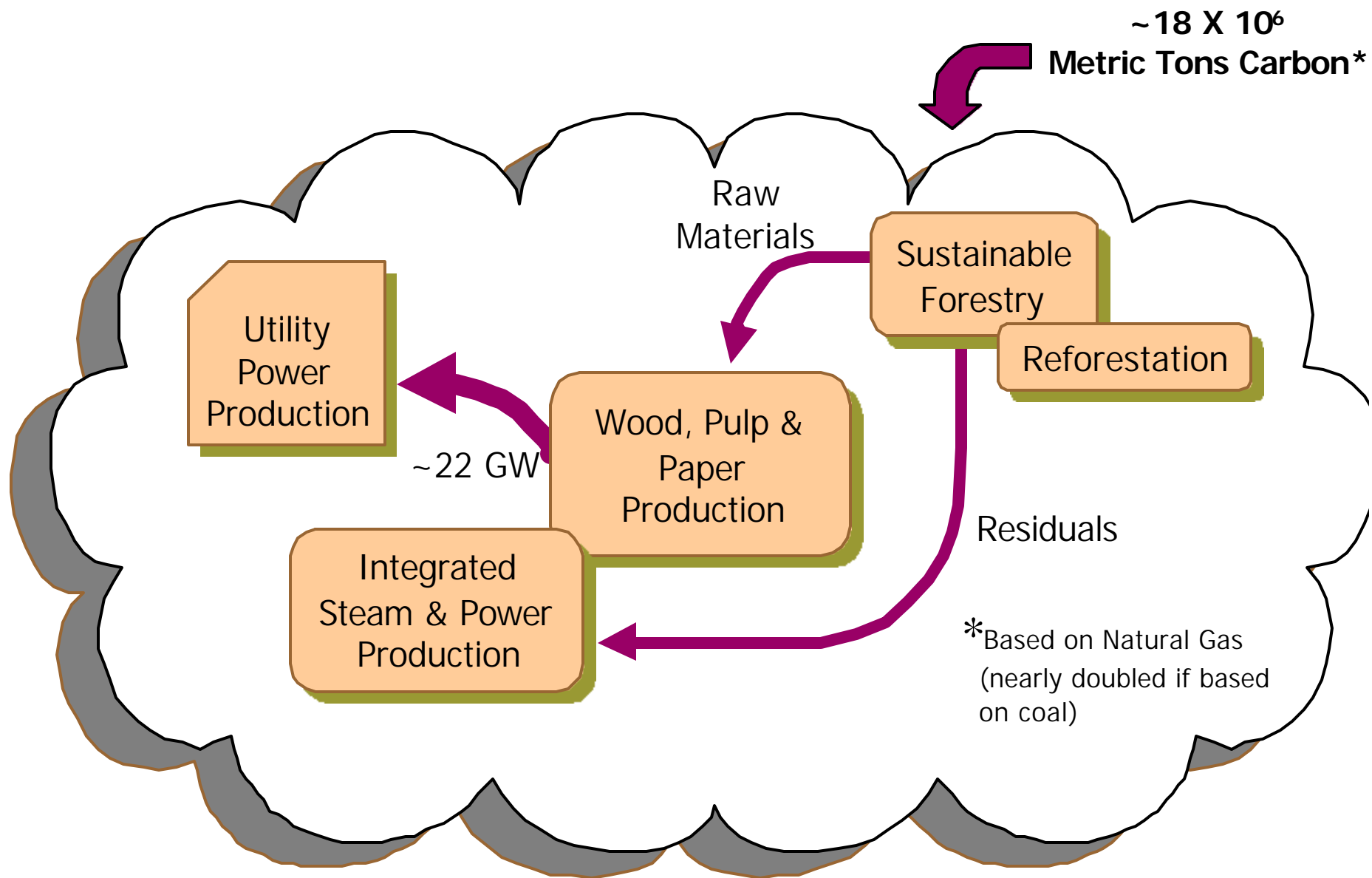
Energy

- Higher energy conversion rate than smelters
- Department of Energy has committed to help with funding of the engineering phase of the project.
- Gasification technology applied to all black liquor recovery and biomass, with combined cycle technology would create a net export of electrical energy.

Pulp, Paper & Packaging Industry Cycle

Today's Powerhouse Technology





Pulp, Paper & Packaging Industry Cycle – Total Replacement with Gasification Combined Cycle Technology